

# TEST PROCEDURE

**TP 717C**

<b>Title</b> Enhanced Diurnal Evaporative Emission Test	<b>Page Number</b> 1 of 33
<b>Originator</b> Ron Driessche, Test Documentation Specialist	<b>Supersedes</b> N/A
<b>Responsible Organization</b> Ozone/Particulate Matter (PM) Vehicle Group	<b>Computer Program</b> Windows NT, VX-In, LabVIEW, Mac Apps.
<b>Type of Test Report</b> Computer	<b>Data Form Number</b> Form 717-01 Form 717-02
<b>Report Distribution</b> Vehicle Programs and Compliance Division, Testing Programs Branch files, and the requesting program office	<b>Implementation Date</b> 04-12-99

## Implementation Approval

Original Test Procedure Authorized on 06-03-97

## Revision Description

- (1) 11-20-97 The purpose of this change is to revise the procedure as described in EPCN #225.
- (2) 04-12-99 The purpose of this change is to revise the procedure as described in EPCN #240.

**Note:** Specific brand names in EPA/EOD procedures are for reference only and are not an endorsement of those products.

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**1. Purpose**

The purpose of this procedure is to quantify evaporative emission losses occurring during 48-hour, 72-hour, and various other simulated diurnal temperature cycles. The test procedure is designed to measure diurnal emissions resulting from daily temperature changes (as well as relatively constant resting losses), measured by the enclosure technique.

Emissions are measured according to a temperature versus time sequence (Attachment A) for each 24-hour cycle, with the highest emission level added to the hydrocarbon amount measured during the 1-hour hot soak test (TP 709).

**2. Test Article Description**

Light-duty vehicles that require evaporative emission testing and the 1996 three-day or two-day diurnal test sequences.

**3. References**

- 3.1 “Code of Federal Regulations,” Title 40, Part 86, Subpart B; Sections 86.105, 86.106, 86.107, 86.113, 86.114, 86.116, 86.117, 86.121, 86.127, 86.130 - 86.133, 86.143, and Appendix II to Part 86
  - 3.2 Environmental Protection Agency (EPA) current safety policies
  - 3.3 EPA Test Procedures, TP 707, TP 709, and TP 718.
- All references include procedures referenced and all subsequent revisions thereof.
- 3.4 MTS-Powertek VTSHED Operator Manual

**4. Required Equipment**

- 4.1 MTS-Powertek Variable Temperature Sealed Housing for Evaporative Determination (VTSHED) system for Sites 1 and 2:
  - 4.1.1 VTSHED  
Equipment used: MTS-Powertek VTSHED
  - 4.1.2 Air handling system to purge the VTSHED and provide a mix of cool and hot air to the VTSHED environment  
Equipment used: Heating, Neslab HTC 1200  
Refrigerated, Neslab NX 500

## 4.1.3 Flame Ionization Detector (FID)

Equipment used: Pierburg PM 2000

## 4.1.4 Computer

Equipment used: Plato P54C/PCI Baby-AT Diamond Multimedia  
MotherboardMacintosh Power PC 7600/132 for the VTSBED  
Macintosh computer

## 4.1.5 Monitor

Equipment used: CTX 15 inch color for the VTSBED computer IBM  
compatible computerApple Color Plus 14 inch for the VTSBED Macintosh  
computer

## 4.1.6 Data Acquisition System

Equipment used: Inter Bus-S (IBS) in conjunction with LabVIEW  
software/hardware

## 4.2 Ambient Monitoring System

## 4.2.1 Barometer

Equipment used: Setra 270

## 4.2.2 Temperature measurement

Equipment used: 1/4" type "J" thermocouple, for under vehicle  
measurementResistance Temperature Detector (RTD), for VTSBED  
side wall measurement

## 4.3 Vehicle Information (VI) sheet

## 4.4 VTSBED Test Report

## 4.5 Form 717-01, "Enhanced Evap Process and Required Times" (Attachment C)

## 4.6 Form 717-02, "Enhanced Diurnal Evaporative Emission Test Checklist" (Attachment D)

## 5. Precautions

The symbols < > are used to indicate a key on the computer keyboard.

Example: Push <1> to start. This means that you need to push the key labeled “1” to start the device.

- 5.1 VTSLED seals, especially around the perimeter of the VTSLED floor, should be periodically inspected for leakage.
- 5.2 Before performing a test, the VTSLED operator must become familiar with the operation of the VTSLED emergency exit door.
- 5.3 Before performing a test, the operator checks the water level in the “Neslab” refrigerated circulation tank and the “Neslab” heating circulation tank and fills if necessary.
- 5.4 Before performing a test, the VTSLED operator must become familiar with the operation of the Quartech push-button (PB) station red Emergency Stop button (Attachment B). Quartech PB stations are located on the inside and outside walls of the VTSLED, at the computer station, and inside the VTSLED near the emergency exit door.
- 5.5 The VTSLED is automatically purged when the concentration of hydrocarbons, methanol, or both exceeds 15,000 ppmC.
- 5.6 The VTSLED is equipped with a visual alarm to indicate lower explosion limits (LEL). The VTSLED operator should be familiar with the VTSLED safety features described in the MTS VTSLED Operator Manual.
- 5.7 Test vehicles must be moved in and out of the VTSLED with caution to minimize the possibility of damage to the enclosure and/or the vehicle. The test vehicle must not be driven or crabbed in or out of the VTSLED.
- 5.8 The test must be aborted if vehicle coolant leaks are observed in the VTSLED.
- 5.9 Immediately after the computer template display loads, the VTSLED Temperature Setpoint should be set to 22.22 °C (72 °F) to prevent it from defaulting to 33.30 °C.
- 5.10 When new data is entered/modified in the “Header” and “Test Control” screens, the fields must be overwritten with new test data otherwise previous test data will be used as header information for the new test. The <Enter> key must not be used when the cursor is in a field.
- 5.11 The Quartech PB station must be in “Local” status to open and close the VTSLED door, seal the door, and purge the SHED. The Quartech PB station must be in “Remote” status to operate these functions from the computer and to start the diurnal test.

**6. Visual Inspection**

- 6.1 Before the test, check the water level in the heating and refrigerated circulation tanks and fill, if necessary.
- 6.2 Visual inspections are included as part of the test preparation and test procedures.

**7. Test Article Preparation**

The test vehicle shall be soaked for not less than 6 hours nor more than 36 hours between the end of the hot soak test and the start of the diurnal emission test. For at least the last 6 hours of this period, the vehicle shall be soaked at  $72 \pm 3^\circ \text{F}$ . For the three-diurnal test, the temperature tolerance may be waived for up to 10 minutes to allow purging of the VTSHED or transporting the vehicle into the VTSHED at the beginning of the diurnal emission test.

The date and time of completion along with the initials of the person completing the steps are recorded on Form 717-01, Attachment C.

The VTSHED operator is responsible for assuring that Form 717-01 has been completed, all times are within specification, and the following preparatory steps are performed prior to the diurnal evaporative emission test. Completion of these preparatory steps are documented on Form 717-02, Attachment D.

- 7.1 Check the span gas cylinders. If the bottle pressure are less than 500 pounds per square inch (psi), notify the senior technician. If they are less than 200 psi, do not start the test.
- 7.2 Ensure the FID power is on and verify that the VTSHED FID flame is lit by looking at the red LED on the panel under the computer keyboard. The FID flame is routinely left burning continuously to ensure analyzer stability. If the burner is off, it must be lighted at least 30 minutes prior to calibration. Notify the senior technician or the Calibration and Maintenance Coordinator in Quality Control Group if there are problems with the FID.
- 7.3 Familiarity with Macintosh and IBM computer systems, FileMaker Pro, Windows NT<sup>®</sup> and VX-In<sup>®</sup> software is necessary. If you are unfamiliar with this software, you should obtain training from a qualified senior technician before attempting VTSHED operation.

See Attachment E if you are unfamiliar with VTSHED #1 and #2 equipment locations. See Attachment F if the electrical power to the VTSHED and or the computer needs to be turned on.

**Note:** At the control system enclosure, the upper portion of the VTSHED computer screen contains selection information about the VTSHED environment via seven displays available to monitor the VTSHED. The lower portion of the screen always contains the template display (Attachment G) providing test and screen control functions.

- 7.4 On the template, click in the field under "TEMPERATURE SET POINT" and use the keyboard to enter "22.22" (72 °F) to prevent it from defaulting to 33.30 °C.

- 7.5 Check the water level in the “Neslab” refrigerated circulation tank and fill if necessary.
- 7.6 Check the water level in the “Neslab” heating circulation tank and fill, if necessary.
- 7.7 On the template, click on the following buttons:
- “Volume Control Off” - when selected, the button will change from gray to green and display “Volume Control On.”
- “Temperature Control Off” - when selected, the button will change from gray to green and display “Temperature Control On.”
- “Vent Fan Off” - when selected, the button will change from gray to green and display “Vent Fan On.”
- “Aux Fan Off” - when selected, the button will change from gray to green and display “Aux Fan On.”
- 7.8 For each gas, ensure that the following gas regulator panel toggle switches are in the on position and the gages are set to 22 - 25 psi when the gas is flowing.
- FID FUEL
- ZERO AIR
- SPAN 2
- SPAN 3
- SPAN 4

**Note:** The SPAN 1 switch remains in the off position.

- 7.9 Calibrate the analyzer:
- 7.9.1 On the template screen, use the mouse and click on “FID Manual Control” (Attachment H).
- 7.9.2 On the front panel of the analyzer, click on <Remote>.
- 7.9.3 On the “FID Manual Control” screen, click on:
- “Remote”
- “Auto-Range”
- “Calibrate”
- The analyzer will perform a preset calibration routine lasting approximately 5 minutes. When the calibration is complete the “Calibrate” button will extinguish and the “Standby” button will be highlighted.

- 7.9.4 On the “FID Manual Control” screen, click on “Purge.”
- 7.9.5 When the “Measured HC (ppm)” field displays less than 1.5, click on “Sample.”
- 7.10 On the template display, click on the “Menu Selection” pull-down menu, drag to the “Forms,” and release the mouse button. When the “Form.vi” screen appears, use the mouse and click on the “Parameter Type” pull-down menu and drag to “Header” (Attachment I), if necessary. Use the keyboard or mouse to enter or select the correct data in the fields under the corresponding headings on the screen. Do not use <Enter> when the cursor is in the fields.

The fields will contain entries from the last test performed and may need to be overwritten with the new test information. If this is not done, the entries from the previous test will be retained as header information for the new test. For vehicle tests, data from the VI sheet is entered.

**Note:** Items designated “Leave Blank” are used as headers in the printout.

- 7.10.1 On page 1, enter:

<u>Parameter</u>	<u>For Certification Testing</u>
VTSHED#	
Start_Date	
Vehicle_ID#	
TSD_Test#	
Test_Purpose	Cert
VT_SHED_Test_Type	2-Day Diurnal
VT_SHED_Test_Cycle	CERT
TSD_Test_Proc#	23
Customer_Division	VPCD
Customer_Name	
Start_Temp_(F)	72
Test_Length_(hrs)	48
Fuel_Type_(RVP)	9.0 RVP
Temp_for_FTP_(F)	68-86
Can_Load_Rate	
Can_Load_Level	



7.10.2 Click on the page arrow for page 2 and enter the following:

**Note:** Items identified as “Leave Blank” are used for labeling purposes only.

<u>Parameter</u>	<u>For Certification Testing</u>
------------------	----------------------------------

Can_Start_Wt_(g)	
Can_End_Wt_(g)	
Technician_Name	
Test_&_Vehicle_Info:	Leave Blank
TestControl_Parameters:	Leave Blank
Post_Test_Data_Entry:	Leave Blank
Start_Date_&_Time	Leave Blank
End_Date_&_Time	Leave Blank
HC_Mass_@_24_Hrs_(g)	Leave Blank
HC_Mass_@_48_Hrs_(g)	Leave Blank
Hot_Soak_HC_(ppm)	Leave Blank
Hot_Soak_HC_(g)	Leave Blank

- 7.11 The fields may contain entries from the last test performed and may need to be overwritten with the new test information. If this is not done, the entries from the previous test will be retained as header information for the new test.

On the “Form.vi” screen, use the mouse to click on the “Parameter Type” pull-down menu, drag to “Test Control” (Attachment J), and release the mouse button. If necessary, use the keyboard to enter the correct data in the following fields. Do not use <Enter> when the cursor is in the fields. For vehicle tests, data from the VI sheet or the data shown below is entered.

<u>Parameter</u>	<u>For Certification Testing</u>
Vehicle_Vol_(m <sup>3</sup> )	1.42
Shed_Total_Vol_(m <sup>3</sup> )	69.944
K_(si)	17.16
FID_Read_Freq_(min)	0
Temp_Stability_(C)	1
Time_Stability_(sec)	120
#_of_Cycles	1
Log_Order_List	CERT.LOL
Log_Interval	1
LogIntervalUnits	minutes

When all data have been entered, click on “Save.” Click on “OK” in the pop-up window confirming the save, then and click on “Exit.”

- 7.12 Click on the template “Maint. Screen” button and review the status indicators (Attachment K) to verify that they are lighted green. If they are not, notify the senior technician or the Calibration and Maintenance Coordinator in Quality Control Group

Chiller “WATER FLOWING”

Facility “AIR PRESSURE OK”

Facility “WATER PRESSURE OK”

Heater “WATER FLOWING”

If the status is chiller “WATER NOT FLOWING,” facility “AIR PRESSURE LOW” or “WATER PRESSURE LOW,” or heater “WATER NOT FLOWING.”

“VENT FAN ON” If the status is “VENT FAN OFF,” ensure that the template display “VENT FAN ON” button is activated.

“DOOR CLOSED” If the status is “DOOR OPEN,” ensure that the VTSLED door was properly closed and sealed by inspecting the door and checking the status of the Quartech PB station.

- 7.13 On the template display use the mouse to click the “Test Cycle” pull down menu, drag to “CERT,” and release the mouse button. The type of test to be run is listed on the VI sheet. Click on “OK.”

- 7.14 Open the VTSLED door, if it is not already open, by performing the following steps:

See Attachment B for a diagram of the Quartech push-button (PB) station.

- 7.14.1 Go to the Quartech PB station located on the outside wall of the VTSLED and verify that the “Local/Remote” light emitting diode (LED) is yellow indicating local control. If it is green, momentarily click on the “Local” push-button until it turns yellow.

- 7.14.2 Press and hold the “Vehicle Door Open” push-button. The associated LED will turn green and the door will raise to the full open position. It will stop and the LED will turn red. Release the push-button. The LED will turn off.

- 7.14.3 Lower the cross-over bridge into the doorway floor channel.

- 7.15 If it is not already in the VTSLED, carefully push the test vehicle, with the engine shut off and the windows and luggage compartment(s) opened, into the VTSLED. Do not crab the test vehicle in or out of the VTSLED.

- 7.16 Position the thermocouple marked #3 beneath the vehicle gas tank.

- 7.17 Position the portable fan to force air under the test vehicle, ensure that it is plugged in to the “Controlled” outlet and both the fan power switch and circuit breaker, located on the plug, are turned on.
- 7.18 Close the VTSLED door by performing the following steps:
- 7.18.1 Raise the cross-over bridge from the doorway floor channel.
  - 7.18.2 Go to the Quartech PB station on the VTSLED outside wall and press and hold the “Vehicle Door close” push-button. The associated LED will turn green, the door will lower to the fully closed position. It will stop and the LED will turn red. Release the push-button. The LED will turn off.
  - 7.18.3 Check that the door is fully closed by pushing down on the handle. Apply sufficient pressure to ensure complete door closure.
- 7.19 At the rear of the VTSLED, verify that the emergency door is closed and sealed. If the LED on the door sensor mechanism is on, the proximity switch is activated and door is closed and sealed. If the LED is not lighted, secure the door. If the door will not properly seal, notify the senior technician or the Calibration and Maintenance Coordinator in Quality Control Group.
- 7.20 On the Quartech PB station, momentarily press the “Local/Remote” push-button. The LED will turn green to verify remote control. If it is yellow, momentarily press the push-button until the LED turns green. The VTSLED purge system will automatically shut-off.

## 8. Test Procedure

The VTSLED operator is responsible for ensuring that the following steps are performed during the diurnal test.

### 100 Diurnal Evaporative Emission Test

The diurnal emission test for gasoline, methanol, and gaseous-fueled vehicles consists of three or two 24-hour test cycles following the 6-36 hour vehicle soak. VTSLED operating temperatures are automatically measured at least every minute.

- 101 Click on the template screen “Start Test” button. When all test conditionals are satisfied, the computer will automatically set-up and run the diurnal test.

Within 10 minutes of closing and sealing the VTSLED doors, the enclosure atmosphere will be analyzed for hydrocarbons and this value recorded.

**Note:** After the “Start Test” icon is clicked, the VTSLED control system will automatically stabilize the VTSLED environment to the limits specified in the “Header” screens. When all stability requirements have been met, and all equipment status verified, the VTSLED program will seal the main door and close the purge damper.

- 102 Review the following “Maint. Screen” status indicators to verify that they are green. If problems are found, notify the senior technician.

Chiller “WATER FLOWING”

Facility “AIR PRESSURE OK”

Facility “WATER PRESSURE OK”

Heater “WATER FLOWING”

“PURGE DAMPER CLOSED”

“DOOR CLOSED”

“DOOR SEALED”

“VENT FAN ON”

- 103 Click on the template “Status Screen” button. The “Test Time” in HH, MM, SS format will be displayed for the duration of the test. For the two-diurnal test, duration is 48 hours. For the three-diurnal test, duration is 72 hours.

At the end of the test, the “Status” screen (Attachment L) will display “No Test in Progress.”

## **200 Data Transfer**

- 201 On the computer keyboard, simultaneously press <CTRL> and <ESC> to switch to “Task List.”

- 202 Double-click on “File Manager.” If “File Manager” is not on the list, double-click on:

“Program Manager- EPA1/EPA,” for VTSLED #1

“Program Manager- EPA2/EPA2,” for VTSLED #2

then double-click on the “File Manager” icon

- 203 Locate and click on the “POWERTEK.APP” folder.“

From that folder locate and double-click on the “SHED 1.0” folder.

From that folder locate and double-click on the “DATA” folder.

- 204 On the right side of the screen, locate and click (do not double-click) on the test data file, "48HrCert.txt."

**Note:** The data file is a tab-delimited ASCII text file containing the recorded test results and the pre-test information which was entered on the "Header" and "Test Control" screens. The following steps will produce 2 versions of the data, a re-named original tab-delimited text file, and an "Excel" copy.

- 205 Rename the test data file by using the mouse to click on "File," drag to "Rename."

Use the keyboard to enter the file name in the following format:

TestNumber.txt

Do not enter any spaces or dashes in this number. The "TestNumber" is the last six digits of the TSD Test number.

Press <Enter>.

- 206 On the keyboard, Press <Ctrl> and <Esc> to switch to "Task List."

Find "Excel" and double-click on it. If "Excel" is not on the list, double-click on "Program Manager-EPA1\EPA," or "Program Manager-EPA2\EPA2," then double-click on the "excel" icon.

- 207 Create an "Excel" version of the test data by using the mouse to click on "File," drag to "Open." Double-click the following:

"C:\\" folder

"POWERTEK.APP"

"SHED 1.0"

"DATA"

Use the mouse to click on "List Files of Type:" and drag to "All Files (\*.\*)"."

Double-click on your file named in Step 205 (this is a ".txt file). When "Text Import Wizard" appears, click on "Finish."

Use the mouse to click on "File" and drag to "Save As," then click on "Save Files as Type:" and drag to "Microsoft Excel Workbook." Click on "OK." Click on "OK" again.

- 208 Save the test data file on a floppy disk by inserting an IBM formatted floppy disk in the floppy disk drive located behind the locking door.

Use the mouse to click on "File" and drag to "Save As." Select "A" from the "Drives" pop-up menu. Click "OK."

**Note:** You must click on the word "OK" for this button to work.

209 Use the mouse to click on “File” and drag to “Close,” then click on “File” and drag to “Exit” to close the “Excel” program.

210 On the keyboard, press and hold <Alt> and press and release <Tab> until “Status Screen” appears. Release <Alt>.

211 On the keyboard, press and hold <Alt> and press and release <Tab> until “Template” appears. Release <Alt>.

212 Eject the floppy disk by pressing the black button below the disk slot.

### **300 Vehicle Removal**

301 Go the Quartech push-button (PB) station and momentarily press the push-button associated with “Local”/“Remote” until the light turns yellow, indicating local control.

302 Press the “Vehicle Door Seal” push-button to deflate the VTSHED door seal.

**Note:** The light will turn green and a sixty second timer will allow the door to completely deflate before any other door operations may be activated. The light will extinguish.

303 Press and hold the “Vehicle Door Open” push-button. The associated LED will turn green and the door will open as long as the push-button is pressed until fully open whereupon it will stop and the LED will turn red. Release the push-button.

304 Lower the cross-over bridge into the doorway floor channel.

305 Close the test vehicle windows and luggage compartments, and remove the test vehicle (with the engine shut off) from the VTSHED.

**9. Data Input**

- 9.1 Before the test begins, the technician enters the following vehicle test data on the “Form.vi” header screen:

**Page 1**

<u>Parameter</u>	<u>For Certification Testing</u>
VTSHED#	
Start_Date	
Vehicle_ID#	
TSD_Test#	
Test_Purpose	Cert
VT_SHED_Test_Type	2-Day Diurnal
VT_SHED_Test_Cycle	CERT
TSD_Test_Proc#	23
Customer_Division	VPCD
Customer_Name	
Start_Temp_(F)	72
Test_Length_(hrs)	48
Fuel_Type_(RVP)	9.0 RVP
Temp_for_FTP_(F)	68-86
Can_Load_Rate	
Can_Load_Level	

**Page 2**

<u>Parameter</u>	<u>For Certification Testing</u>
Can_Start_Wt_(g)	
Can_End_Wt_(g)	
Technician_Name	
Test_&_Vehicle_Info:	Leave Blank
TestControl_Parameters:	Leave Blank
Post_Test_Data_Entry:	Leave Blank
Start_Date_&_Time	Leave Blank
End_Date_&_Time	Leave Blank
HC_Mass_@_24_Hrs_(g)	Leave Blank
HC_Mass_@_48_Hrs_(g)	Leave Blank
Hot_Soak_HC_(ppm)	Leave Blank
Hot_Soak_HC_(g)	Leave Blank

- 9.2 If necessary, the technician enters the following vehicle test data on the “Test Control” screen:

<u>Parameter</u>	<u>For Certification Testing</u>
Vehicle_Vol_(m <sup>3</sup> )	1.42
Shed_Total_Vol_(m <sup>3</sup> )	69.944
K_(si)	17.16
FID_Read_Freq_(min)	0
Temp_Stability_(C)	1
Time_Stability_(sec)	120
#_of_Cycles	1
Log_Order_List	CERT.LOL
Log_Interval	1
LogIntervalUnits	minutes

- 9.3 At the completion of the test, if not already on, turn the Macintosh VTSHED Interface computer power on and enter the correct password.
- 9.4 In the launcher, click on the “Data Processing” button, then click on the following three buttons, in the order shown below. Enter your name and password where required.
- 1.- VT Processing
  - 2.- Vol 1
  - 3.- Process VTSHED Data
- 9.5 Insert the floppy disk containing the copy of the test data. Double-click on the floppy disk icon and locate the test data file. The file name will be the same as the last six-digits of TSD Test Number with ~1.xls added to the end. In this procedure it shall be referred to as “Test #~1.xls” from now on.
- 9.6 Click on and drag “Test #~1.xls” file to the “Drag PC Data Here” icon, located in “Process VTSHED Data” folder. When the “Test #~1.xls” file is on top of the icon, release the mouse button. The file will be converted to a Macintosh format and will appear in this folder as “Test#~1.xls(Converted).”
- 9.7 Close the floppy disk window and eject the disk.
- 9.8 In “Process VTSHED Data” folder, double-click on the “VTSHED Processor” file.
- 9.9 When the file opens, enter the six-digit TSD test number. Do not enter any dashes or spaces between the characters.
- 9.10 Enter EPA identification number and press the enter key.
- 9.11 Click on the “Start Processing” button.



- 9.12 When the “Replace the existing Test #~1.(Converted) file?” dialog box appears, click on the “Yes” button.
- 9.13 Validate that the data highlighted on the screen corresponds to the data on the VI Sheet. If it does not, correct it. When all the data is verified to be correct, click on the “OK” button.
- 9.14 Click on the “Get Hot Soak HC” button.
- 9.15 Click on the “Create 1-Line File” button.
- 9.16 In the “Process VTSBED Data” folder, click on and drag the file named “Transfer” so that it is on top of the “Drag Transfer Here” icon . This creates the “Transfer (Converted)” file.
- 9.17 From the “Process VTSBED Data” folder, drag the files named “Transfer” and “Test#~1.XLS” into the trash.
- 9.18 In the “Process VTSBED Data” folder, double-click on “VTSBED Test Report.” and enter your password.
- 9.19 Click on the “Import” button.
- 9.20 Click on “Print Report” button.
- 9.21 Verify you have the correct test number and place the hard-copy printout of the “VTSBED Test Report “ in the test packet.
- 9.22 From the “Process VTSBED Data” folder, drag the file named “Transfer (Converted)” into the trash.
- 9.23 If data processing is completed, close the files.

## 10. Data Analysis

- 10.1 All printed computer output files and test records are verified by a technician who did not enter the data.
- 10.2 The technician checks the data for completeness, accuracy, and compliance with EPA regulations. He/she will write his/her identification number and date in the “Verified By” area of the forms. This certifies that the data are accurate and complete.
- 10.3 Span and zero points are verified for all analyzer calibrations.
- 10.4 VTSBED temperature traces are checked to assure that readings have been correctly identified and tolerances have been adhered to during the diurnal tests.

**11. Data Output**

- 11.1 Electronic copies of the test data are transferred to the MIAARBR4.EPA server.
- 11.2 Forms 709-01, 717-01 and 717-02 are filed in the test packet.
- 11.3 The “VTSHED Test Report” is filed in the test packet.

**12. Acceptance Criteria**

The following criteria must be met for the test to be valid:

- 12.1 The vehicle shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution.
- 12.2 Ambient temperature levels encountered by the test vehicle shall be not less than 68 °F nor more than 86 °F, unless otherwise specified.
- 12.3 The test vehicle shall be soaked for not less than 6 hours nor more than 36 hours between the end of the hot soak test and the start of the diurnal emission test. For at least the last 6 hours of this period, the vehicle shall be soaked at  $72 \pm 3$  °F. For the three-diurnal test sequence, the temperature tolerance may be waived for up to 10 minutes to allow purging of the enclosure or transporting the vehicle into the enclosure at the beginning of the diurnal emission test.
- 12.4 The record shall show a positive indication of the initiation and completion of the diurnal emission test, including initiation and completion of the sampling period(s).
- 12.5 The VTSHED shall be purged prior to the test. The blowers used to purge the enclosure shall have sufficient flow capacity to reduce the enclosure hydrocarbon and/or methanol concentration from the test level to the ambient level between tests. If at any time the concentration of hydrocarbons, of methanol or of methanol and hydrocarbons exceeds 15,000 ppm C the enclosure should be immediately purged.
- 12.6 The test vehicle engine shall be shut off and the windows and luggage compartment(s) shall be opened when it is moved into the diurnal enclosure.
- 12.7 Enclosures shall be equipped with two ambient temperature sensors, connected to provide one average output, located 3 feet above the floor at the approximate mid-length of each side wall of the enclosure and within 3 to 12 inches of each side wall. For diurnal emission testing, an additional temperature sensor shall be located underneath the vehicle to provide a temperature measurement representative of the air temperature under the fuel tank.
- 12.8 Interior surface temperatures shall not be less than 40 °F at any time during the diurnal emission test.

- 12.9 The temperature recording system shall record each temperature at least once every minute. The recording system shall be capable of resolving time to  $\pm 15$  s and capable of resolving temperature to  $\pm 0.75$  °F ( $\pm 0.42$  °C). The temperature recording system (recorder and sensor) shall have an accuracy of  $\pm 3$  °F ( $\pm 1.7$  °C). The recorder (data processor) shall have a time accuracy of  $\pm 15$  s and a precision of  $\pm 15$  s.
- 12.10 The recording system shall record each pressure at least once every minute. The recording system used to record the enclosure gage pressure for any testing in an enclosure shall be capable of resolving time to  $\pm 15$  s and capable of resolving pressure to  $\pm 0.1$  inches of water. The pressure recording system (recorder and sensor) shall have an accuracy of  $\pm 1.0$  inch of water. The recorder (data processor) shall have a time accuracy of  $\pm 15$  s and a precision of  $\pm 5$  s. The VTSLED shall limit the differential between the enclosure internal pressure and the barometric pressure to a maximum value of  $\pm 2.0$  inches of water.
- 12.11 Temperatures measured with the under-body temperature sensor shall follow the profile with a maximum deviation of 3 °F at any time and an average temperature deviation not to exceed 2 °F, where the average deviation is calculated using the absolute value of each measured deviation. The temperature from the side wall temperature sensors shall follow the profile with a maximum deviation of 5 °F at any time. Ambient temperatures shall be measured at least every minute. Temperature cycling shall begin when time=0 minutes.
- 12.12 Prior to sampling for emissions and throughout the period of cycled ambient temperatures, the mixing fan shall circulate the air at a rate of  $0.8 \pm 0.2$  cfm per cubic foot of ambient volume. The mixing fan, plus any additional fans if needed, shall also maintain a minimum wind speed of 5 mph (8 km/hr) under the fuel tank of the test vehicle. The fan speed and location may be adjusted to ensure sufficient air circulation around the fuel tank. The wind speed requirement may be satisfied by consistently using a fan configuration that has been demonstrated to maintain a broad 5-mph air flow in the vicinity of the vehicle's fuel tank.
- 12.13 Within 10 minutes of closing and sealing the VTSLED doors, enclosure atmosphere shall be analyzed for hydrocarbons and recorded. This is the initial (time=0 minutes). Hydrocarbon emissions may be sampled continuously during the test period. The electrical output of the FID used for measuring hydrocarbons (or hydrocarbons plus methanol, as appropriate) shall be recorded at least at the initiation and termination of each running loss and hot soak test, and at least at the initiation and termination of the enclosure sampling period(s) for the diurnal emission test. The FID (or HFID) hydrocarbon analyzer shall be zeroed and spanned immediately prior to the sampling. The FID (or HFID) hydrocarbon analyzer shall be zeroed and spanned immediately prior to the end of each emission sampling period.
- 12.14 For the three-diurnal test sequence, the end of the first, second, and third emission sampling period shall occur  $1440 \pm 6$ ,  $2880 \pm 6$ ,  $4320 \pm 6$  minutes, respectively, after the beginning of the initial sampling. At the end of each emission sampling period, the enclosure atmosphere shall be analyzed for hydrocarbons and recorded.

- 12.15 For the supplemental two-diurnal test sequence, the test vehicle shall be soaked for not less than 6 hours nor more than 36 hours between the end of the hot soak test, and the start of the two- diurnal emission test. For at least the last 6 hours of this period, the vehicle shall be soaked at  $72\pm3$  °F. The vehicle shall be tested for diurnal emissions except that the test includes only two 24-hour periods. Therefore the end of the first and second emission sampling periods shall occur  $1440\pm6$  and  $2880\pm6$  minutes, respectively, after the initial sampling.
- 12.16 If tests are invalidated after collection of emission data from previous test segments, the test may be repeated to collect only those data points needed to complete emission measurements. Compliance with emission standards may be determined by combining emission measurements from different test runs. If any emission measurements are repeated, the new measurements supersede previous values.
- 12.17 At the end of the temperature cycling period the enclosure doors shall be unsealed and opened, the test vehicle windows and luggage compartments may be closed and the test vehicle, with the engine shut off, shall be removed from the enclosure.

### 13. Quality Control Provisions

These provisions are guidelines which ensure test data quality. Noncompliance does not necessarily invalidate tests.

Any deviations are reported to the senior technician for further action.

- 13.1 Gas regulator are set to 22 - 25 psi for each gas when the span gas is flowing.
- 13.2 If the FID is off, a minimum warm-up time of 30 minutes is required after lighting.
- 13.3 The FID analyzer is calibrated prior to sampling, and the calibration is verified immediately after a sample is analyzed to ensure minimal analyzer drift.
- 13.4 A continuous hydrocarbon sample may be taken to provide a record of emission during the diurnal test.
- 13.5 All clock times are taken from the calibrated digital clocks provided on-site.
- 13.6 The technician validates the data as described on Attachment A.
- 13.7 The technician's identification number must appear on all forms and test records, certifying that the data are accurate and complete.
- 13.8 Deviations from this procedure are documented on Form 902-01. In general, these deviations will void the data. However, the customer may choose to accept the data as variant. To do this, the customer must indicate acceptance by signing and dating Form 902-01.

## Temperature Versus Time Sequence

### Three Diurnal

Table 1-Temperature Versus Time Sequence					
Use linear interpolation between hourly temperatures					
Time (min)	Temp (°F)	Time (min)	Temp (°F)	Time (min)	Temp (°F)
0	72.0	60	72.5	120	75.5
180	80.3	240	85.2	300	89.4
360	93.1	420	95.1	480	95.8
540	96.0	600	95.5	660	94.1
720	91.7	780	88.6	840	85.5
900	82.8	960	80.9	1020	79.0
1080	77.2	1140	75.8	1200	74.7
1260	73.9	1320	73.3	1380	72.6
1440	72.0	1500	72.5	1560	75.5
1620	80.3	1680	85.2	1740	89.4
1800	93.1	1860	95.1	1920	95.8
1980	96.0	2040	95.5	2100	94.1
2160	91.7	2220	88.6	2280	85.5
2340	82.8	2400	80.9	2460	79.0
2520	77.2	2580	75.8	2640	74.7
2700	73.9	2760	73.3	2820	72.6
2880	72.0	2940	72.5	3000	75.5
3060	80.3	3120	85.2	3180	89.4
3240	93.1	3300	95.1	3360	95.8
3420	96.0	3480	95.5	3540	94.1
3600	91.7	3660	88.6	3720	85.5
3780	82.8	3840	80.9	3900	79.0
3960	77.2	4020	75.8	4080	74.7
4140	73.9	4200	73.3	4260	72.6
4320	72.9				

### Two Diurnal

Table 1-Temperature Versus Time Sequence					
Use linear interpolation between hourly temperatures					
Time (min)	Temp (°F)	Time (min)	Temp (°F)	Time (min)	Temp (°F)
0	72.0	60	72.5	120	75.5
180	80.3	240	85.2	300	89.4
360	93.1	420	95.1	480	95.8
540	96.0	600	95.5	660	94.1
720	91.7	780	88.6	840	85.5
900	82.8	960	80.9	1020	79.0
1080	77.2	1140	75.8	1200	74.7
1260	73.9	1320	73.3	1380	72.6
1440	72.0	1500	72.5	1560	75.5
1620	80.3	1680	85.2	1740	89.4
1800	93.1	1860	95.1	1920	95.8
1980	96.0	2040	95.5	2100	94.1
2160	91.7	2220	88.6	2280	85.5
2340	82.8	2400	80.9	2460	79.0
2520	77.2	2580	75.8	2640	74.7
2700	73.9	2760	73.3	2820	72.6
2880	72.0				

From: "Code of Federal Regulations," Title 40, Part 86, Subpart B, Appendix II

Quartech PB Station

Emerg.  
Stop

Vehicle Door Open	Vehicle Door Close	Vehicle Door Seal	Shed Purge
Door Opening	Door Closing	OffOn	OffOn
Not Allowed	Not Allowed	Unsealing or Not Allowed	Delayed Purge Not Allowed

	Local	Lower Explosive Limit Alarm Ack.	System Fault
	Remote		
	Not Allowed	Fault	No Fault

## Enhanced Evap Process and Required Times

Vehicle ID # \_\_\_\_\_ Test Number \_\_\_\_\_

☐ Canister Load Only - 2-Day Diurnal Data Not Required

\_\_\_ Vehicle Inspection Completed

\_\_\_ Drain Fuel and Fill to 40% Completed

\_\_\_ Drive to soak area and park.

1 ..... Start 6-hr soak. Record "key off" date/time

Date	Time	Initial
	+6:00	

Add 6 hours to the "key off" time recorded above.

2 ..... **Do not start the vehicle before**

Date	Time

Drive to twin-roll dyno for preconditioning.

3 ..... End 6-hr soak. Record "key on" date/time

Date	Time	Initial

\_\_\_ PREP LA-4 Completed

\_\_\_ Drain Fuel and Fill to 40% Completed - within 1-hr of Prep

Drive to soak area and park. - within 5 min. of refueling

4 ..... Start 12 -36-hr soak. Record "key off" date/time

Date	Time	Initial
	+12:00	

Add 12 hours to the "key off" time recorded above.

5 ..... **Do not start the vehicle before**

Date	Time

I have verified that the required time limits are not exceeded according to TP 701 through TP 717.

Verified by: \_\_\_\_\_ Date: \_\_\_\_\_

\_\_\_ Canister Preconditioning Completed

FTP Cold / Hot Start Exhaust Tests Completed

6 ..... End 12-36-hr soak. Record FTP "key on" date/time

Date	Time	Initial

### 2 Day Diurnal Data:

1-hour SHED Hot Soak Completed - Do not drive.

7 ..... Start 6-36-hr soak. Record hot soak "end" date/time

Date	Time	Initial
	+6:00	

Add 6 hours to the time recorded above.

8 ..... **Do not start Two-Day Diurnal before**

Date	Time

Add 30 hours to the time recorded above (to get 36 hour max time)

9 ..... **Two-Day Diurnal must be started before**

Date	Time

\_\_\_ Three-minute SHED Purge Completed

10 ..... Record 2-Day Diurnal "Start" date/time

Date	Time	Initial
	+48:00	

Add 48 hours to the time recorded above.

11 ..... The 2-Day Diurnal will end

Date	Time

I have verified that the required time limits are not exceeded according to TP 701 through TP 720.

Verified by: \_\_\_\_\_ Date: \_\_\_\_\_

## Enhanced Diurnal Evaporative Emission Test Checklist

Vehicle ID # \_\_\_\_\_ Test Number \_\_\_\_\_

VTSHED 1 ☐ VTSHED 2 ☐

Test Type: 2-Day Diurnal ☐ 3-Day Diurnal ☐ Other \_\_\_\_\_

- ☐ Vehicle soaked 6 - 36 hours after hot soak and last 6 hours at  $72 \pm 3$  °F.
- ☐ Span gas cylinders >500 psi. If <200 psi, don't start test.
- ☐ FID flame lit.
- ☐ Temperature set-point at 22.22°C
- ☐ Chiller and Heater tank water level OK
- ☐ Volume Control, Temperature Control, Vent Fan, Aux Fan buttons turned on
- ☐ Gas regulator panel toggle switches on and gages set to 22 - 25 psi:
- ☐ Analyzer calibrated.
- ☐ Header and Test Control screens completed.
- ☐ Maintenance screen buttons lighted:
  - Chiller "WATER FLOWING"                      • Heater "WATER FLOWING"
  - Facility "WATER PRESSURE OK"              • Facility "AIR PRESSURE OK"
  - "DOOR CLOSED"                              • "VENT FAN ON"
- ☐ Test type selected in "TEST CYCLE."
- ☐ Test vehicle in VTSHED with windows & luggage compartment(s) opened
- ☐ Thermocouple #3 under vehicle gas tank.
- ☐ Fan positioned, plugged in controlled outlet, & fan power switch and circuit breaker on.
- ☐ VTSHED door closed
- ☐ Emergency door closed & sealed.
- ☐ PB station "Local/Remote" push-button green for remote control.
- ☐ Maintenance Screen, "DOOR SEALED" button lighted.

I have performed all steps in accordance with the requirements of Test Procedure 717.

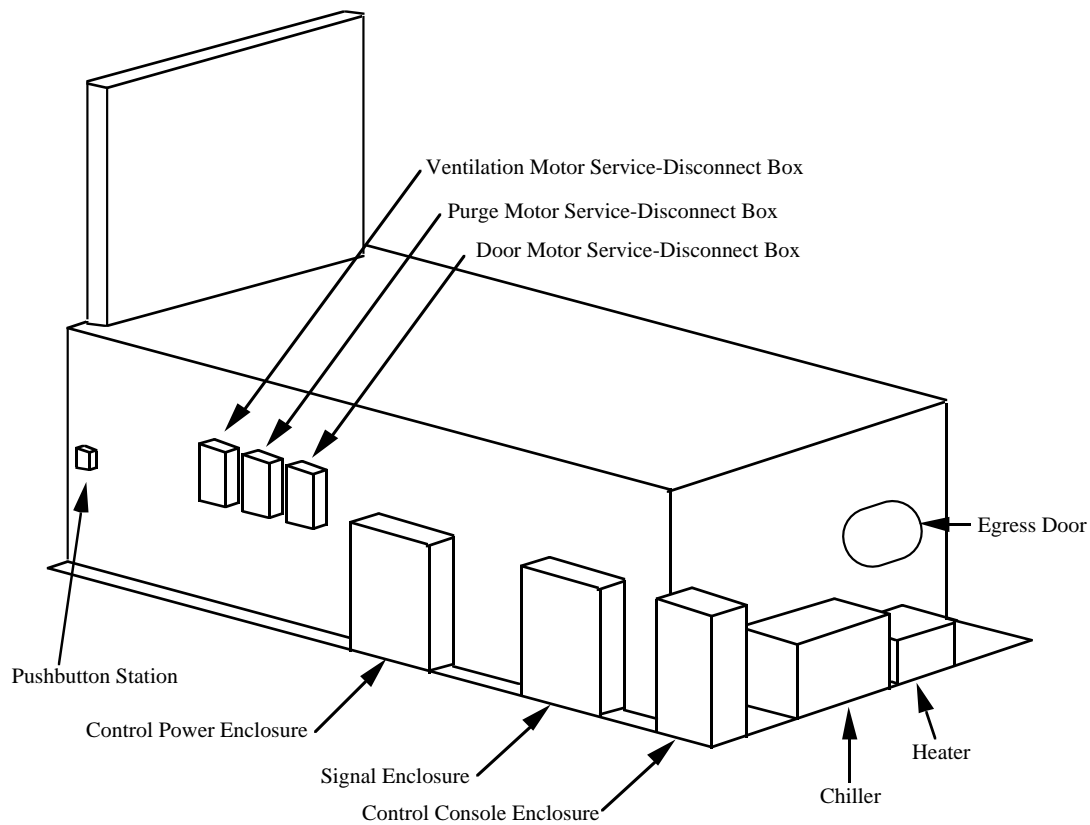
Technician's ID \_\_\_\_\_ Date \_\_\_\_\_

The data entries are correct and meet the requirements of Test Procedure 717.

Verified by \_\_\_\_\_ Date \_\_\_\_\_



## MTS Powertek VTSHED Equipment Layout



## MTS Powertek VTSLED, Power-Up and Computer Set-up

1. If they are not already on, turn on the circuit breakers in the 480 Volt ac power transformer in the marked cabinet located on the south side of the column next to VTSLED #2.
2. If they are not already on, turn on the main and eight circuit breakers labeled for the VTSLED being used in the 120/240 volt cabinet located in the marked cabinet located on the north side of the column next to VTSLED #2.
3. Check the water level in the "Neslab" refrigerated circulation tank and fill if necessary.
4. Check the water level in the "Neslab" heating circulation tank and fill, if necessary.
3. For the following, move the knife switches to "ON":
  - Ventilation motor service-disconnect box on the outside wall of the VTSLED
  - Purge motor service-disconnect box on the outside wall of the VTSLED
  - Door motor service-disconnect box on the outside wall of the VTSLED
4. Ensure that the breakers in the power enclosure cabinet are turned on.
5. On the refrigerated circulation service-disconnect box, move the knife switch to "ON." On the chiller control panel, toggle the chiller power switch to "On," then to "Start."
6. On the heating circulation service-disconnect box, move the knife switch to "ON." On the heater control panel, toggle the heater power switch to "On," then to "Start."
7. For VTSLED #1 or #2, go to the control console and verify that the computer is turned on. If it is not, turn on the computer power with the red switch located behind the locking door. Wait for Windows NT® to boot.
8. Computer Operation - see Macintosh Operating Manual for instructions.
9. At the screen prompt, use the computer keyboard and simultaneously press <Ctrl>, <Alt>, and <Delete>.
10. Press <Enter> in response to the password prompt. The computer screen will display "Windows"® icons.
11. Click on the "Program Manager." icon, then double-click on the "PowerTek VTSLED" icon.

## Template Screen

<b>Alarm Group</b> DEFAULT.LIM ▼		<b>Temperature Setpoint</b> 22.22 0 100		<b>Heat Blanket Setpoint</b> 0.00 0 100		<b>2/11/97 3:47:46 PM</b> Mailer	
<b>Comments</b>  							
<b>Test Manager</b>		<b>Comm. Screen</b>	<b>Maint. Screen</b>	<b>Status Screen</b>	<b>FID Manual</b>	<b>Soft Stop</b>	<b>Start Test</b>
<b>Feedback Setup</b>	<b>SHED PID Tune</b>	<b>Aux. Fan OFF</b>	<b>Vent.Fan ON</b>	<b>Volume Cntrol ON</b>	<b>Temp Cntrol ON</b>	<b>Heat Blkt OFF</b>	<b>Exit</b>
<b>Messages</b>		Recording Stopped ▼				<b>DELETE</b>	<b>CLEAR</b>
<b>System</b> epa.fil		<b>Display Screen</b> Status_Screen ▼		<b>Menu Selection</b> ▼		<b>Test Cycle</b> CERT ▼	

## FID Manual Control Screen

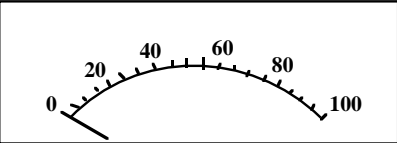
<b>FID Manual Control</b>									
			<b>EPA</b>	<b>Range Limit (ppm)</b>	<b>Span Bottle Concentration (ppm)</b>	<b>Choose Span Bottles to Modify</b>			
<b>STANDBY</b>	<b>PURGE</b>	<b>SAMPLE</b>	0	0.00	0.00	Bottle #1 Range	Bottle #1 Concentration		
<b>MANUAL</b>	<b>ZERO</b>	<b>SPAN</b>	0	0.00	0.00	Bottle #2 Range	Bottle #2 Concentration		
<b>REMOTE</b>	<b>CALIBRATE</b>	<b>WARM UP</b>	0	0.00	0.00	Bottle #3 Range	Bottle #3 Concentration		
<b>AUTORANGE</b>	<b>RANGE 1</b> ▼		0	0.00	0.00	Bottle #4 Range	Bottle #4 Concentration		

<b>FID Status</b>								
Online	Sample	Otto Cycle	Auto-Range	Retard Mode	Program Automatic	Range Limit Check	Linear-ization	Adjust-ment
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



0.00

Measured HC (ppm)





## Header Screens



### Page Number 1 Header

Load Save		Page   1 of 2		Parameter Type Header ▼		Exit	
VTSLED_# VT2 ▼		Start_Date 5/1/97		Vehicle_ID# xx01		TSD_Test# 19970000001	
Test_Purpose Cert ▼		VTSLED_Test_Type 2-Day Diurnal ▼		VT_SHED_Test_Cycle CERT		TSD_Test_Proc# 23 ▼	
Customer_Division VPCD ▼		Customer_Name John Doe		Start_Temp_(F) 72 ▼		Test_Length_(hrs) 48 ▼	
Fuel_Type_(RVP) 9.0 RVP ▼		Temp_for_FTP_(F) 68-86 ▼		Can_Load_Rate		Can_Load_Level	

### Page Number 2 Header

Load Save		Page   2 of 2		Parameter Type Header ▼		Exit	
Can_Start_Wt_(g)		Can_End_Wt_(g)		Technician_Name Jane Doe ▼		Test_&_Vehicle_Info:	
TestControl_Parameters:		Post-Test_Data_Entry:		Start_Date_&_Time		End_Date_&_Time	
HC_Mass_@_24_Hrs_(g)		HC_Mass_@_48_Hrs_(g)		Hot_Soak_HC_(ppm)		Hot_Soak_HC_(g)	

## Test Control Screen

<input type="button" value="Load"/>		<input type="button" value="Save"/>		Page   1 of 1		Parameter Type		<input type="button" value="Exit"/>	
						<input type="button" value="Test Control"/> ▼			
Vehicle_Vol_(m^3)		SHED_Total_Vol_(m^3)		K_(si)		FID_Read_Freq_(min)			
<input type="text" value="1.42"/>		<input type="text" value="69.944"/>		<input type="text" value="17.16"/> ▼		<input type="text" value="0"/>			
Temp_Stability_(C)		Time_Stability_(sec)		#_of_Cycles		Log_Order_List			
<input type="text" value="1"/> ▼		<input type="text" value="120"/> ▼		<input type="text" value="1"/> ▼		<input type="text" value="CERT.LOL"/> ▼			
Log_Interval		LogIntervalUnits							
<input type="text" value="1"/> ▼		<input type="text" value="Minutes"/> ▼							

Maintenance Screen

Chiller (deg C)

WATER NOT FLOWING

Supply Temperature 0.0

Return Temperature 0.0

Neslab Temperature 0.0

Neslab SetPoint 0.0

Maintenance

SHED Temperature (deg C)

Feedback 0.0 Setpoint 0.0

250 500 750 1000

0

250 500 750 1000

0

Feedback Channels

Left SHED Temperature

Right SHED Temperature

Heater (deg C)

WATER NOT FLOWING

Supply Temperature 0.0

Return Temperature 0.0

Neslab Temperature 0.0

Neslab SetPoint 0.0

Facility

Water Supply Temperature 0.0 (deg /c)

AIR PRESSURE LOW

WATER PRESSURE LOW

DOOR UNSEALED

DOOR OPEN

VENT FAN OFF

PURGE DAMPER OPEN

METRIC

## Status Screen

### Status

#### Thermocouple Jacks (deg c)

1	▼	Fuel Temp	22.2
2	▼	Under Engine	22.5
3	▼	Under Tank	22.1
4	▼	Outlet Temp	19.3

#### Test Information

FID Status Complete

No Test  
In Progress

☐ METRIC

#### SHED Atmosphere

Differential Pressure  kPa  
Relative Humidity  %  
Barometer  kPa

#### SHED Temperature (deg C)

Left   
Right   
Average

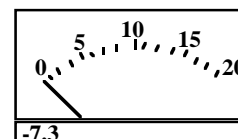
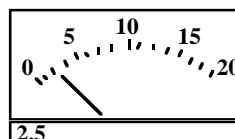
#### SHED Air Analysis

HC Mass  gm HC ppm

#### Lower Explosive Limit (%)

Front CGD

Rear CGD





VTSHED Test Report

VTSHED Test Report

TSD Test # 1997036-9009

Time history data can be found in the file 1997036-9009.xls on the I-Drive in the folder "TSD\PCVT"

Test Info

Vehicle ID Number 00-0

VT SHED Number VT1

Test Procedure 23

Test Purpose Cert

Test Type 2-Day Diurnal

Test Length 48 hours

Technician Name Bob Moss

Customer Name Jane Doe

Customer Division VPCD

Fuel Type IND

Temperature for FTP 68-86 °F

Start Temperature 72 °F

Results

Start Date 4/30/97

Start Time 5:29 AM

End Date 5/2/97

End Time 5:29 AM

2-Day Diurnal Evap Loss

Hot Soak Evap Loss

Total Evap Loss

3.65

0.27

3.92

g HC

g HC

g HC

2-Day Diurnal Standard: 2.5 g HC

The 2-Day Diurnal test result is the highest of the 2 daily total HC measurements.

Day 1 Total 3.48 g HC

Day 2 Total 3.65 g HC

To determine if the standard was exceeded, the 2-Day Diurnal is added to the Hot Soak. The Total HC is compared to the Evaporative Standard.